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Abstract

CONTROL OF GAS-BORNE ACTIVITY ARISING FROM REACTOR FAULTS

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To ensure that any gas-borne activity arising from an accident to a reactor of the A.G.R. type will be adequately trapped, the preferred trapping system (which consists of a charcoal adsorber and high efficiency filters) has been tested over the relevant range of conditions. I-131 is the most dangerous fission product and the difficulty in trapping it is related to the chemical and physical forms which it can assume. The trapping system was therefore tested with fission products released from irradiated fuel pencils heated in various CO_2/CO/air mixtures. At temperatures a little above the melting point of the can, releases of iodine, tellurium and caesium were between 10 and 50% but that of strontium was less than 0.2%.

It was found that the principal features of the behaviour of the I-131 in the release could, by a suitable technique, be usefully reproduced using separated I-131. A considerable proportion was carried on fume, but no penetration of the absolute filter was detected. Vapour compounds were found which did not deposit rapidly on copper surfaces and the most penetrating of them were identified as methyl and other alkyl iodides, previously found in separated carrier-free iodine diluted with clean air. Interconversion of the various forms was studied in the gas phase and on surfaces.

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Charcoal was found to delay methyl iodide by physical adsorption but only to retain it permanently if the loading was below a certain limit. For the standard material (chosen for its good retention of other forms) the limit was about 1μg/g of charcoal at 100°C, and less at room temperature but alternative charcoals have been found with a higher limit even at room temperature.

Freshly released fission products at concentrations of 10^{-3} - 10^{+3} $\mu g/m^3$ were found to penetrate a trapping system including a 10 cm. charcoal bed to an extent ranging from one part in 10^3 at the lower concentration to one in 10^5 at the higher, and methyl iodide formed a considerable proportion of the gaseous activity.

The only serious penetration of any fission product occurred in an experiment in which large amounts of activity were released in conditions favouring compound formation. Prolonged elution of the heavily loaded bed resulted in penetration by iodine activity identified mainly as alkyl iodides. The total loading was an order of magnitude above the methyl iodide limit for the charcoal used, but lay within the limit of satisfactory operation for some charcoals since tested.